

SEQUENCE LISTING

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 Asp Phe Ile Tyr Gln Asp Gly Phe Ser Thr Ala Gly Ile Thr Gln Ile
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 Gly Arg Gly Val Gly Ile Gly Ala Val Met Gly Asn Phe Gly Gln Gly
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 Ser Phe Glu Thr Thr Thr Glu Ala Thr Asp Leu Ala Ile Gly Gly Arg
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 Gly Phe Phe Lys Val Lys Pro Gln Gly Ser Glu Thr Ser Tyr Tyr Thr
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 His Gly Tyr Ala Leu Gln Gly Trp Lys Ile Asp Asn Thr Glu Gly Pro
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Ala	Pro	Leu	Gln	Thr	Thr	Asn	Val	Ser	Phe	Asn	Val	Asn	Leu	Ser	Ser	
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Lys Thr His Asn Pro Met Asp Val Ala Gly Gly Trp Thr Val Gly Gly						
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Tyr Lys Thr Pro Ala Pro Ser Val Thr Glu Leu Gly Met Ala Gln Ile						
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Gly Thr Ala Ala Asp Ile Lys Lys Glu His Trp Pro His Asn Ala Ala						
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Val Tyr Ser Asn Gly Val Gln Leu Pro Leu Tyr Gln Val Ala Leu Tyr						
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Val Lys Pro Gln Gly Ser Glu Thr Ser Tyr Tyr Thr Arg Ala Gly Asn
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Phe Arg Phe Asn Asn Asp Gly Tyr Leu Val Asp Pro His Gly Tyr Ala
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Glu Pro Thr Asp Ile Arg Leu Asp Thr Trp Thr Val Ala Pro Leu Gln
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Asp Lys Ser Gln Asn Val Asn Ser Pro Phe Thr Ser Leu Phe Asn Ile
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 Met Asp Pro Ser Glu Asp Asn Arg Gln Val Ser Val Gly Gly Asn Ile
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 385 390 395 400
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 595 600 605
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Phe Thr Val Gly Ile Ile Met Leu Ile Leu Ala Cys Leu Ala Ala Leu
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gag ttc ata caa gat ttt ccc aat agc tat caa gaa gat gga caa atg      148
Glu Phe Ile Gln Asp Phe Pro Asn Ser Tyr Gln Glu Asp Gly Gln Met
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gtt aca gga att att tca aaa ata ata ggc tct aac tgt gat aat tct      196
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tca aca tct gat ata aat aat aag aaa tcc ata gat aga gat aaa gat      244
Ser Thr Ser Asp Ile Asn Asn Lys Lys Ser Ile Asp Arg Asp Lys Asp
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aca tta ctc tca agt agt aat aga aat aca ata caa gcc ggt act cca      292
Thr Leu Leu Ser Ser Ser Asn Arg Asn Thr Ile Gln Ala Gly Thr Pro
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cat caa gaa aat aac ata aaa gaa gat ctt caa ctg act aac aaa aat      340
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gaa caa aca act cca gaa gaa gaa gaa gaa agt aaa ttt att tgg tta      388
Glu Gln Thr Thr Pro Glu Glu Glu Glu Glu Ser Lys Phe Ile Trp Leu
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aca gaa gct cca tca gag ctt aaa aaa gga gaa aaa gct ata aca caa      436
Thr Glu Ala Pro Ser Glu Leu Lys Lys Gly Glu Lys Ala Ile Thr Gln
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aca aga ttg tct att ggt aag gat ata tct ttt aga att act gct gat      484
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gat gcc atc aaa gct caa tca atg atg tta aaa aat cca gat agg ttt      532
Asp Ala Ile Lys Ala Gln Ser Met Met Leu Lys Asn Pro Asp Arg Phe
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Val Leu Asp Leu Gln Gly Lys Trp Gly Ile Ser Leu Pro Pro Ile Pro
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cct aca aat cct tgg tta aaa aaa ata cgc tta ggt act aat aat gga      628
Pro Thr Asn Pro Trp Leu Lys Lys Ile Arg Leu Gly Thr Asn Asn Gly
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aat aca cga ctt gtc ttt gat ctt caa aaa aaa cca tct aaa act gaa      676
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Tyr Gln Glu Asp Gly Gln Met Val Thr Gly Ile Ile Ser Lys Ile Ile
 35 40 45

Gly Ser Asn Cys Asp Asn Ser Ser Thr Ser Asp Ile Asn Asn Lys Lys
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Ser Ile Asp Arg Asp Lys Asp Thr Leu Leu Ser Ser Ser Asn Arg Asn
 65 70 75 80

Thr Ile Gln Ala Gly Thr Pro His Gln Glu Asn Asn Ile Lys Glu Asp
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Leu Gln Leu Thr Asn Lys Asn Glu Gln Thr Thr Pro Glu Glu Glu Glu
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 130 135 140

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Leu	Tyr	Trp	Glu	Glu	Arg	Phe	Gln	Pro	Ile	Pro	Asp	Ala	Asn	Ala	Ile		
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Ala	Thr	Gly	Ala	Asp	Tyr	Leu	Ile	Trp	Gly	Gln	Val	Asn	Ile	Val	Gly		
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gat	gaa	gct	acg	ctt	gat	gta	caa	g	tgt	gat	ata	gaa	gga	tca	att	390	
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Gln	Asp	Thr	Ala	Asp	Ala	Ile	Asn	Ser	Glu	Leu	Phe	Gly	Arg	Ala	Thr		
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Val	Gln	Glu	Ile	Ile	Val	Ser	Cys	Phe	Asp	Pro	Ser	Tyr	Ala	Lys	Pro	
	265					270					275					
tat	tcg	ttt	att	ctt	agt	ttt	aaa	aat	aga	gtg	ttt	aaa	gag	tta	gcc	918
Tyr	Ser	Phe	Ile	Leu	Ser	Phe	Lys	Asn	Arg	Val	Phe	Lys	Glu	Leu	Ala	
280					285					290					295	
aca	aac	tta	cca	ttt	tat	tta	aat	gtg	gtt	aaa	ctt	cca	cca	gat	ttt	966
Thr	Asn	Leu	Pro	Phe	Tyr	Leu	Asn	Val	Val	Lys	Leu	Pro	Pro	Asp	Phe	
				300					305					310		
tct	cct	atg	tta	att	ggg	caa	aag	agt	gac	aat	tca	agg	att	ttt	tct	1014
Ser	Pro	Met	Leu	Ile	Gly	Gln	Lys	Ser	Asp	Asn	Ser	Arg	Ile	Phe	Ser	
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ccc	tct	ggg	gtt	tat	gaa	ata	gaa	aaa	cat	gga	cgt	aac	tat	ata	atg	1062
Pro	Ser	Gly	Val	Tyr	Glu	Ile	Glu	Lys	His	Gly	Arg	Asn	Tyr	Ile	Met	
		330					335					340				
gga	aat	cgt	ctt	agt	ctt	cca	aag	gaa	gct	aat	att	ttt	aat	ttt	tct	1110
Gly	Asn	Arg	Leu	Ser	Leu	Pro	Lys	Glu	Ala	Asn	Ile	Phe	Asn	Phe	Ser	
	345					350					355					
tgg	tta	cca	tca	gat	tca	tta	aaa	gat	gaa	gaa	gct	aag	tta	gta	ctt	1158
Trp	Leu	Pro	Ser	Asp	Ser	Leu	Lys	Asp	Glu	Glu	Ala	Lys	Leu	Val	Leu	
360					365					370					375	
gta	acc	aat	aat	gaa	aga	tta	gtt	gta	tat	aat	aca	aaa	ggg	aca	aga	1206
Val	Thr	Asn	Asn	Glu	Arg	Leu	Val	Val	Tyr	Asn	Thr	Lys	Gly	Thr	Arg	
				380					385					390		
ctt	ttt	atg	act	gaa	gaa	gtg	tat	tat	ggg	tct	tct	gtt	ggg	ata	gac	1254
Leu	Phe	Met	Thr	Glu	Glu	Val	Tyr	Tyr	Gly	Ser	Ser	Val	Gly	Ile	Asp	
			395					400					405			
gag	ccc	agt	aat	atg	cct	ggg	ctt	gga	aag	tca	aaa	gag	ctt	atc	cct	1302
Glu	Pro	Ser	Asn	Met	Pro	Gly	Leu	Gly	Lys	Ser	Lys	Glu	Leu	Ile	Pro	
		410				415						420				
tct	aaa	tat	ttt	atc	cca	gga	cgg	atg	att	cct	att	aat	ctt	gat	tca	1350
Ser	Lys	Tyr	Phe	Ile	Pro	Gly	Arg	Met	Ile	Pro	Ile	Asn	Leu	Asp	Ser	

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      425              430              435
atg ggg aaa tgg gag ttg ctt gta agc aag cca att tct gtt gca gca      1398
Met Gly Lys Trp Glu Leu Leu Val Ser Lys Pro Ile Ser Val Ala Ala
440              445              450              455

aaa ttt ttt gaa aat tat aga tct ttt gct gaa ggc gaa att cag gct      1446
Lys Phe Phe Glu Asn Tyr Arg Ser Phe Ala Glu Gly Glu Ile Gln Ala
              460              465              470

tta aca tgg gac ggc tta gga tta ggt ctt gta tgg aat aca cgt cgt      1494
Leu Thr Trp Asp Gly Leu Gly Leu Gly Leu Val Trp Asn Thr Arg Arg
              475              480              485

att aag gga act att aca gat ttt gcc tta gct gat atg aat aat gat      1542
Ile Lys Gly Thr Ile Thr Asp Phe Ala Leu Ala Asp Met Asn Asn Asp
              490              495              500

ggg aag tta gac tta gtt gtt tcc gtt aat agc cat aca ggg att ctt      1590
Gly Lys Leu Asp Leu Val Val Ser Val Asn Ser His Thr Gly Ile Leu
505              510              515

gga cta gaa aaa cga aag aca att ata gta ttt tat cct tta gag gta      1638
Gly Leu Glu Lys Arg Lys Thr Ile Ile Val Phe Tyr Pro Leu Glu Val
520              525              530              535

gat aaa caa ggt atc cct aag gct gtt gaa gat aac taa ttttttccta      1687
Asp Lys Gln Gly Ile Pro Lys Ala Val Glu Asp Asn
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<211> 547
<212> PRT
<213> Lawsonia intracellularis

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Phe Lys Val Asn Ala Pro Pro Ser Tyr Thr Tyr Leu Glu Lys Ala Ile
35              40              45

Pro Ser Met Leu Thr Ser Arg Leu Tyr Trp Glu Glu Arg Phe Gln Pro
50              55              60

Ile Pro Asp Ala Asn Ala Ile Lys Ala Gly Lys Val Glu Asp Ile Lys
65              70              75              80

Glu Met Asp Lys Ala Arg Ile Ala Thr Gly Ala Asp Tyr Leu Ile Trp
85              90              95

Gly Gln Val Asn Ile Val Gly Asp Glu Ala Thr Leu Asp Val Gln Val

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100	105	110
Cys Asp Ile Glu Gly Ser Ile Trp Arg Lys Ser Lys Asn Thr Lys Val		
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Asp Asn Leu Ile Thr Ala Leu Gln Asp Thr Ala Asp Ala Ile Asn Ser		
130	135	140
Glu Leu Phe Gly Arg Ala Thr Thr Lys Pro Ser Ser Lys Ala Thr Ile		
145	150	155
Val Ala Gln Met Asn Ser Gly Leu Ile Lys Gly Lys Gly Asn Glu Asn		
165	170	175
Gln Ser Tyr Leu Asn Pro Glu Phe Arg Tyr Gln Gly Ser Asn Leu Ser		
180	185	190
Arg Gly Arg Ser Gln Ala Leu Pro Phe Ala Ser Val Gly Ile Val Val		
195	200	205
Gly Asp Phe Ile Gly Asp Asn Lys Asn Glu Val Ala Ile Leu Ser Glu		
210	215	220
Tyr Lys Val His Ile Tyr Arg Trp Glu Glu Glu Arg Leu Ala Leu Leu		
225	230	235
Gly Glu Tyr Lys Phe Pro Arg Ser Leu Gln Ser Leu His Ile Arg Ala		
245	250	255
Phe Asp Val Asp His Asp Gly Val Gln Glu Ile Ile Val Ser Cys Phe		
260	265	270
Asp Pro Ser Tyr Ala Lys Pro Tyr Ser Phe Ile Leu Ser Phe Lys Asn		
275	280	285
Arg Val Phe Lys Glu Leu Ala Thr Asn Leu Pro Phe Tyr Leu Asn Val		
290	295	300
Val Lys Leu Pro Pro Asp Phe Ser Pro Met Leu Ile Gly Gln Lys Ser		
305	310	315
Asp Asn Ser Arg Ile Phe Ser Pro Ser Gly Val Tyr Glu Ile Glu Lys		
325	330	335
His Gly Arg Asn Tyr Ile Met Gly Asn Arg Leu Ser Leu Pro Lys Glu		
340	345	350
Ala Asn Ile Phe Asn Phe Ser Trp Leu Pro Ser Asp Ser Leu Lys Asp		
355	360	365

Glu Glu Ala Lys Leu Val Leu Val Thr Asn Asn Glu Arg Leu Val Val
 370 375 380

Tyr Asn Thr Lys Gly Thr Arg Leu Phe Met Thr Glu Glu Val Tyr Tyr
 385 390 395 400

Gly Ser Ser Val Gly Ile Asp Glu Pro Ser Asn Met Pro Gly Leu Gly
 405 410 415

Lys Ser Lys Glu Leu Ile Pro Ser Lys Tyr Phe Ile Pro Gly Arg Met
 420 425 430

Ile Pro Ile Asn Leu Asp Ser Met Gly Lys Trp Glu Leu Leu Val Ser
 435 440 445

Lys Pro Ile Ser Val Ala Ala Lys Phe Phe Glu Asn Tyr Arg Ser Phe
 450 455 460

Ala Glu Gly Glu Ile Gln Ala Leu Thr Trp Asp Gly Leu Gly Leu Gly
 465 470 475 480

Leu Val Trp Asn Thr Arg Arg Ile Lys Gly Thr Ile Thr Asp Phe Ala
 485 490 495

Leu Ala Asp Met Asn Asn Asp Gly Lys Leu Asp Leu Val Val Ser Val
 500 505 510

Asn Ser His Thr Gly Ile Leu Gly Leu Glu Lys Arg Lys Thr Ile Ile
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Val Phe Tyr Pro Leu Glu Val Asp Lys Gln Gly Ile Pro Lys Ala Val
 530 535 540

Glu Asp Asn
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 <213> Lawsonia intracellularis

<220>
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 <222> (41)..(1522)

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gct cag ttt aat aaa ccc tct tta ctt gat gaa acc cct ata gat tac Ala Gln Phe Asn Lys Pro Ser Leu Leu Asp Glu Thr Pro Ile Asp Tyr 25 30 35	151
agt tct gta ctt tct gat tac ata gta gaa tta gaa aaa gaa cca ctt Ser Ser Val Leu Ser Asp Tyr Ile Val Glu Leu Glu Lys Glu Pro Leu 40 45 50	199
cag tat ata tta cta aaa aaa gaa aaa ttt tct caa atg gag ata tat Gln Tyr Ile Leu Leu Lys Lys Glu Lys Phe Ser Gln Met Glu Ile Tyr 55 60 65	247
aat tat caa ttc aca tca caa cat tgg tct cca gat aat ttt gta tca Asn Tyr Gln Phe Thr Ser Gln His Trp Ser Pro Asp Asn Phe Val Ser 70 75 80 85	295
cct gct ata tgg gaa cat cag gta gat ata tat atc cct cac cat cca Pro Ala Ile Trp Glu His Gln Val Asp Ile Tyr Ile Pro His His Pro 90 95 100	343
gtt tca gaa cgt gca ctt ctt atc atc aat aat ggt att aat aat ggt Val Ser Glu Arg Ala Leu Leu Ile Ile Asn Asn Gly Ile Asn Asn Gly 105 110 115	391
aca ttt ttt act tct cct aaa gct cca act gat ttt act cca gaa gta Thr Phe Phe Thr Ser Pro Lys Ala Pro Thr Asp Phe Thr Pro Glu Val 120 125 130	439
tta gaa gaa atc gct cgt tca aca aaa act gta gtc att gct cta agt Leu Glu Glu Ile Ala Arg Ser Thr Lys Thr Val Val Ile Ala Leu Ser 135 140 145	487
gat atc cca aat cag tat ctt act tat aga ggt gac tgg aga ttt ctt Asp Ile Pro Asn Gln Tyr Leu Thr Tyr Arg Gly Asp Trp Arg Phe Leu 150 155 160 165	535
aag gaa gat gaa agt att gct atg agt tgg tct agt ttt tta caa gat Lys Glu Asp Glu Ser Ile Ala Met Ser Trp Ser Ser Phe Leu Gln Asp 170 175 180	583
cca gaa agt cgg tac aca aga cct ctc tat gtc cct atg gtt gca gca Pro Glu Ser Arg Tyr Thr Arg Pro Leu Tyr Val Pro Met Val Ala Ala 185 190 195	631
gtt tct cag gca atg act ctt gca gaa aag gag tta caa gca tta aaa Val Ser Gln Ala Met Thr Leu Ala Glu Lys Glu Leu Gln Ala Leu Lys 200 205 210	679
att aag cat ttt att gta tct ggt gtg tca aag cgt gga tgg aca aca Ile Lys His Phe Ile Val Ser Gly Val Ser Lys Arg Gly Trp Thr Thr 215 220 225	727
tgg ctt tca gct att gct gac tca cga gta gat gct att acc ccg ttt Trp Leu Ser Ala Ile Ala Asp Ser Arg Val Asp Ala Ile Thr Pro Phe 230 235 240 245	775
gtt att gat gca ttg aat act cgg aaa gtc ctt gga cat atg tat aaa Val Ile Asp Ala Leu Asn Thr Arg Lys Val Leu Gly His Met Tyr Lys 250 255 260	823
aca tat gga aat aat tgg cct ata gca ttt tat cca tat tat aga ttt	871

Thr Tyr Gly Asn Asn Trp Pro Ile Ala Phe Tyr Pro Tyr Tyr Arg Phe	
265 270 275	
gat tta gat aaa caa cta gat aca gtt cct ttt ttc aat ctt atg aat	919
Asp Leu Asp Lys Gln Leu Asp Thr Val Pro Phe Phe Asn Leu Met Asn	
280 285 290	
att gtt gat cca tat aga tat tta gga aca cca tat aag tct cga ctt	967
Ile Val Asp Pro Tyr Arg Tyr Leu Gly Thr Pro Tyr Lys Ser Arg Leu	
295 300 305	
gct atc cct aaa tat att gta aat gca agt gga gat gat ttt tat gtc	1015
Ala Ile Pro Lys Tyr Ile Val Asn Ala Ser Gly Asp Asp Phe Tyr Val	
310 315 320 325	
cct gat aat tca agt ttt tac tat gat gat ctc cct gga gag aaa gca	1063
Pro Asp Asn Ser Phe Tyr Tyr Asp Asp Leu Pro Gly Glu Lys Ala	
330 335 340	
tta cgt ttt gca cca aac tca aat cat cat ggg ata tta aat ttc aca	1111
Leu Arg Phe Ala Pro Asn Ser Asn His His Gly Ile Leu Asn Phe Thr	
345 350 355	
aaa caa tcg ctt att cct ttt gtg aat aga gta caa aaa ggt att tca	1159
Lys Gln Ser Leu Ile Pro Phe Val Asn Arg Val Gln Lys Gly Ile Ser	
360 365 370	
acg cca gtt tta gat att tcc aca gag atg acg gaa cga gtt caa tat	1207
Thr Pro Val Leu Asp Ile Ser Thr Glu Met Thr Glu Arg Val Gln Tyr	
375 380 385	
gtg act gtt cgt ttt tct gaa gtt cca gag aag ata gta ctt tgg aaa	1255
Val Thr Val Arg Phe Ser Glu Val Pro Glu Lys Ile Val Leu Trp Lys	
390 395 400 405	
gca gca aat cca gag tca cga gat ttt cgt tat gcc tgt cgt gtt agg	1303
Ala Ala Asn Pro Glu Ser Arg Asp Phe Arg Tyr Ala Cys Arg Val Arg	
410 415 420	
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Tyr Met Glu Thr Pro Leu His Leu Ser Ala Thr Gly Glu Val Ser Val	
425 430 435	
tca tta gag atc cct tct gta gga tgg caa gct gct ttt att gaa gct	1399
Ser Leu Glu Ile Pro Ser Val Gly Trp Gln Ala Ala Phe Ile Glu Ala	
440 445 450	
aca ttt aaa gat ggt ttt gtt gca aca aca cca gtg tat att tta cca	1447
Thr Phe Lys Asp Gly Phe Val Ala Thr Thr Pro Val Tyr Ile Leu Pro	
455 460 465	
aaa gat ata tat cca cct ata aaa ata cca cct gta cat gga tta tta	1495
Lys Asp Ile Tyr Pro Pro Ile Lys Ile Pro Pro Val His Gly Leu Leu	
470 475 480 485	
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<213> Lawsonia intracellularis

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Thr Pro Ile Asp Tyr Ser Ser Val Leu Ser Asp Tyr Ile Val Glu Leu
35 40 45

Glu Lys Glu Pro Leu Gln Tyr Ile Leu Leu Lys Lys Glu Lys Phe Ser
50 55 60

Gln Met Glu Ile Tyr Asn Tyr Gln Phe Thr Ser Gln His Trp Ser Pro
65 70 75 80

Asp Asn Phe Val Ser Pro Ala Ile Trp Glu His Gln Val Asp Ile Tyr
85 90 95

Ile Pro His His Pro Val Ser Glu Arg Ala Leu Leu Ile Ile Asn Asn
100 105 110

Gly Ile Asn Asn Gly Thr Phe Phe Thr Ser Pro Lys Ala Pro Thr Asp
115 120 125

Phe Thr Pro Glu Val Leu Glu Glu Ile Ala Arg Ser Thr Lys Thr Val
130 135 140

Val Ile Ala Leu Ser Asp Ile Pro Asn Gln Tyr Leu Thr Tyr Arg Gly
145 150 155 160

Asp Trp Arg Phe Leu Lys Glu Asp Glu Ser Ile Ala Met Ser Trp Ser
165 170 175

Ser Phe Leu Gln Asp Pro Glu Ser Arg Tyr Thr Arg Pro Leu Tyr Val
180 185 190

Pro Met Val Ala Ala Val Ser Gln Ala Met Thr Leu Ala Glu Lys Glu
195 200 205

Leu Gln Ala Leu Lys Ile Lys His Phe Ile Val Ser Gly Val Ser Lys
210 215 220

Arg Gly Trp Thr Thr Trp Leu Ser Ala Ile Ala Asp Ser Arg Val Asp
225 230 235 240

Ala Ile Thr Pro Phe Val Ile Asp Ala Leu Asn Thr Arg Lys Val Leu

				245					250							255
Gly	His	Met	Tyr 260	Lys	Thr	Tyr	Gly	Asn 265	Asn	Trp	Pro	Ile	Ala 270	Phe	Tyr	
Pro	Tyr	Tyr 275	Arg	Phe	Asp	Leu	Asp 280	Lys	Gln	Leu	Asp	Thr 285	Val	Pro	Phe	
Phe	Asn 290	Leu	Met	Asn	Ile	Val 295	Asp	Pro	Tyr	Arg	Tyr 300	Leu	Gly	Thr	Pro	
Tyr 305	Lys	Ser	Arg	Leu	Ala 310	Ile	Pro	Lys	Tyr	Ile 315	Val	Asn	Ala	Ser	Gly 320	
Asp	Asp	Phe	Tyr	Val 325	Pro	Asp	Asn	Ser	Ser 330	Phe	Tyr	Tyr	Asp	Asp 335	Leu	
Pro	Gly	Glu	Lys 340	Ala	Leu	Arg	Phe	Ala 345	Pro	Asn	Ser	Asn	His 350	His	Gly	
Ile	Leu	Asn 355	Phe	Thr	Lys	Gln	Ser 360	Leu	Ile	Pro	Phe	Val 365	Asn	Arg	Val	
Gln	Lys 370	Gly	Ile	Ser	Thr	Pro 375	Val	Leu	Asp	Ile	Ser 380	Thr	Glu	Met	Thr	
Glu 385	Arg	Val	Gln	Tyr	Val 390	Thr	Val	Arg	Phe 395	Ser	Glu	Val	Pro	Glu	Lys 400	
Ile	Val	Leu	Trp	Lys 405	Ala	Ala	Asn	Pro	Glu 410	Ser	Arg	Asp	Phe	Arg 415	Tyr	
Ala	Cys	Arg	Val 420	Arg	Tyr	Met	Glu	Thr 425	Pro	Leu	His	Leu	Ser 430	Ala	Thr	
Gly	Glu	Val 435	Ser	Val	Ser	Leu	Glu 440	Ile	Pro	Ser	Val	Gly 445	Trp	Gln	Ala	
Ala	Phe 450	Ile	Glu	Ala	Thr	Phe 455	Lys	Asp	Gly	Phe	Val 460	Ala	Thr	Thr	Pro	
Val 465	Tyr	Ile	Leu	Pro	Lys 470	Asp	Ile	Tyr	Pro	Pro 475	Ile	Lys	Ile	Pro	Pro 480	
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$\langle 210 \rangle$	9
$\langle 211 \rangle$	2096

<212> DNA
 <213> *Lawsonia intracellularis*

<220>
 <221> CDS
 <222> (12)..(2096)

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att ggt agt gga acc gat ttc caa gct atg att gat caa ctt aag aaa      98
Ile Gly Ser Gly Thr Asp Phe Gln Ala Met Ile Asp Gln Leu Lys Lys
   15             20             25

att gag ctt att cct aaa aat aga ctt gta gtt tcc cat gaa caa tgg      146
Ile Glu Leu Ile Pro Lys Asn Arg Leu Val Val Ser His Glu Gln Trp
   30             35             40             45

aca aaa aaa tat aaa gca ttt gaa gag ctt ata aaa aca gtt aaa gat      194
Thr Lys Lys Tyr Lys Ala Phe Glu Glu Leu Ile Lys Thr Val Lys Asp
          50             55             60

act gaa gcg tct tta agt aag cta agt tct gtt ggt gct att tta aaa      242
Thr Glu Ala Ser Leu Ser Lys Leu Ser Ser Val Gly Ala Ile Leu Lys
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aaa gaa ggt tct gtt tca aat act tct gtt gca agc gtt aag gca agt      290
Lys Glu Gly Ser Val Ser Asn Thr Ser Val Ala Ser Val Lys Ala Ser
          80             85             90

tct gat gca tct gat gga aca cat aca att gat gtg aaa cag ctt gca      338
Ser Asp Ala Ser Asp Gly Thr His Thr Ile Asp Val Lys Gln Leu Ala
   95             100            105

aca aac acg att ctt tct aat aat cat att ttt gat tct aaa act gaa      386
Thr Asn Thr Ile Leu Ser Asn Asn His Ile Phe Asp Ser Lys Thr Glu
  110             115            120            125

agt att aat aat aca ggt tca cct ggt atc ttt gct tat gag tat aaa      434
Ser Ile Asn Asn Thr Gly Ser Pro Gly Ile Phe Ala Tyr Glu Tyr Lys
          130            135            140

ggg gaa cta cat gaa gtt gaa gtt cct cca ggt agt gat ctt gaa tat      482
Gly Glu Leu His Glu Val Glu Val Pro Pro Gly Ser Asp Leu Glu Tyr
          145            150            155

ctt gca aca tta ata aac aaa gat tct aat aat cct ggt gtt aaa gca      530
Leu Ala Thr Leu Ile Asn Lys Asp Ser Asn Asn Pro Gly Val Lys Ala
          160            165            170

aac ctt atc aag act ggc gat ggc tat atg ttt agt ctt gaa gga act      578
Asn Leu Ile Lys Thr Gly Asp Gly Tyr Met Phe Ser Leu Glu Gly Thr
          175            180            185

gaa act ggt gca aat gcg act tta tct att tca aat aag aca acg ctt      626
Glu Thr Gly Ala Asn Ala Thr Leu Ser Ile Ser Asn Lys Thr Thr Leu
          190            195            200            205

cca gac ttt aaa gca tct gtt gct acc agc agt gca tta gct aat ggt      674
Pro Asp Phe Lys Ala Ser Val Ala Thr Ser Ser Ala Leu Ala Asn Gly
          210            215            220

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gaa gat aca att att aat act tca gga aca act caa caa ttt tct ttt Glu Asp Thr Ile Ile Asn Thr Ser Gly Thr Thr Gln Gln Phe Ser Phe 225 230 235	722
gaa tac aat gga aga aca ttt act ttc gat att cct tca gga aca aca Glu Tyr Asn Gly Arg Thr Phe Thr Phe Asp Ile Pro Ser Gly Thr Thr 240 245 250	770
gca aaa gaa ctc caa aca gct ata aat gaa aat aca aaa aat aca gga Ala Lys Glu Leu Gln Thr Ala Ile Asn Glu Asn Thr Lys Asn Thr Gly 255 260 265	818
gta cgt gca act ttt gaa aaa cat ggc tca gat ata gta ttg caa tta Val Arg Ala Thr Phe Glu Lys His Gly Ser Asp Ile Val Leu Gln Leu 270 275 280 285	866
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aca tct tct aca aat gaa ctt aca gaa gtt atc cca gga ctt caa att Thr Ser Ser Thr Asn Glu Leu Thr Glu Val Ile Pro Gly Leu Gln Ile 335 340 345	1058
aca cta ctt tcc gaa ggg aaa aca caa att aca att cag act tct act Thr Leu Leu Ser Glu Gly Lys Thr Gln Ile Thr Ile Gln Thr Ser Thr 350 355 360 365	1106
gac gaa gta aaa aaa caa gtt gag aaa gca gta gag tct ata aat aat Asp Glu Val Lys Lys Gln Val Glu Lys Ala Val Glu Ser Ile Asn Asn 370 375 380	1154
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Ser Glu Thr Phe Gly Gln Leu Lys Ile Leu Asp Arg Glu Thr Ile Gly
 480 485 490
 cct gat gca cct tat aca act ctt gat gag gca tta aaa aaa gat cca 1538
 Pro Asp Ala Pro Tyr Thr Thr Leu Asp Glu Ala Leu Lys Lys Asp Pro
 495 500 505
 caa gca gta gca gat ata tta gct ggt agt tct gga ata tct gat tca 1586
 Gln Ala Val Ala Asp Ile Leu Ala Gly Ser Ser Gly Ile Ser Asp Ser
 510 515 520 525
 aca gat ttt tct tat caa gat cat att gtt gga aaa aca caa gct ggt 1634
 Thr Asp Phe Ser Tyr Gln Asp His Ile Val Gly Lys Thr Gln Ala Gly
 530 535 540
 aca tat gat gta aag tat tct gta gat gca agt ggt act ata gga gac 1682
 Thr Tyr Asp Val Lys Tyr Ser Val Asp Ala Ser Gly Thr Ile Gly Asp
 545 550 555
 gtt tac att gga ggt gta aaa gct tct cta tct gat cct gca aaa aat 1730
 Val Tyr Ile Gly Gly Val Lys Ala Ser Leu Ser Asp Pro Ala Lys Asn
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 Ile Tyr Thr Val Thr Ser Gly Pro Ala Thr Gly Leu Ser Ile Ala Val
 575 580 585
 aat aat cgt act cca ggt atc aat gta gaa agt act gta aga gtc aaa 1826
 Asn Asn Arg Thr Pro Gly Ile Asn Val Glu Ser Thr Val Arg Val Lys
 590 595 600 605
 caa ggt aaa ctt agc caa ata caa gaa gca ctt aaa gct gaa gta cag 1874
 Gln Gly Lys Leu Ser Gln Ile Gln Glu Ala Leu Lys Ala Glu Val Gln
 610 615 620
 caa gat cct tta aaa gaa aac aca ggt cct tta att atc atg caa gat 1922
 Gln Asp Pro Leu Lys Glu Asn Thr Gly Pro Leu Ile Ile Met Gln Asp
 625 630 635
 aac tat aag gat gtt atg aaa aat ctt gag aca aga ata gaa aaa gaa 1970
 Asn Tyr Lys Asp Val Met Lys Asn Leu Glu Thr Arg Ile Glu Lys Glu
 640 645 650
 aca caa aga gtt act agt tgg gaa cgt atg atg cgt tta aaa ttt tct 2018
 Thr Gln Arg Val Thr Ser Trp Glu Arg Met Met Arg Leu Lys Phe Ser
 655 660 665
 aga ctt gat gct gta tta gca aaa tat aat cag atg atg tca gca aat 2066
 Arg Leu Asp Ala Val Leu Ala Lys Tyr Asn Gln Met Met Ser Ala Asn
 670 675 680 685
 gct tct agt tta ggg caa ctt ggt gca taa 2096
 Ala Ser Ser Leu Gly Gln Leu Gly Ala
 690

<210> 10
 <211> 694
 <212> PRT
 <213> Lawsonia intracellularis

<400> 10

Met Ala Asp Tyr Leu Ser Gly Gly Ile Ser Phe Gly Gly Ile Gly Ser
 1 5 10 15

Gly Thr Asp Phe Gln Ala Met Ile Asp Gln Leu Lys Lys Ile Glu Leu
 20 25 30

Ile Pro Lys Asn Arg Leu Val Val Ser His Glu Gln Trp Thr Lys Lys
 35 40 45

Tyr Lys Ala Phe Glu Glu Leu Ile Lys Thr Val Lys Asp Thr Glu Ala
 50 55 60

Ser Leu Ser Lys Leu Ser Ser Val Gly Ala Ile Leu Lys Lys Glu Gly
 65 70 75 80

Ser Val Ser Asn Thr Ser Val Ala Ser Val Lys Ala Ser Ser Asp Ala
 85 90 95

Ser Asp Gly Thr His Thr Ile Asp Val Lys Gln Leu Ala Thr Asn Thr
 100 105 110

Ile Leu Ser Asn Asn His Ile Phe Asp Ser Lys Thr Glu Ser Ile Asn
 115 120 125

Asn Thr Gly Ser Pro Gly Ile Phe Ala Tyr Glu Tyr Lys Gly Glu Leu
 130 135 140

His Glu Val Glu Val Pro Pro Gly Ser Asp Leu Glu Tyr Leu Ala Thr
 145 150 155 160

Leu Ile Asn Lys Asp Ser Asn Asn Pro Gly Val Lys Ala Asn Leu Ile
 165 170 175

Lys Thr Gly Asp Gly Tyr Met Phe Ser Leu Glu Gly Thr Glu Thr Gly
 180 185 190

Ala Asn Ala Thr Leu Ser Ile Ser Asn Lys Thr Thr Leu Pro Asp Phe
 195 200 205

Lys Ala Ser Val Ala Thr Ser Ser Ala Leu Ala Asn Gly Glu Asp Thr
 210 215 220

Ile Ile Asn Thr Ser Gly Thr Thr Gln Gln Phe Ser Phe Glu Tyr Asn
 225 230 235 240

Gly Arg Thr Phe Thr Phe Asp Ile Pro Ser Gly Thr Thr Ala Lys Glu
 245 250 255

Leu Gln Thr Ala Ile Asn Glu Asn Thr Lys Asn Thr Gly Val Arg Ala
 260 265 270

Thr Phe Glu Lys His Gly Ser Asp Ile Val Leu Gln Leu Glu Gly Thr
 275 280 285

Val Pro Asn Gln Gln Val Lys Val Thr Ala Ser Pro Thr Asp Leu Gly
 290 295 300

Ser Phe Thr Ser Ser Gly Gln Ala Gly Trp Asn Lys Arg Asp Ser Gln
 305 310 315 320

Asp Ala Ile Phe Asn Ile Asn Gly Trp Asp Gln Glu Leu Thr Ser Ser
 325 330 335

Thr Asn Glu Leu Thr Glu Val Ile Pro Gly Leu Gln Ile Thr Leu Leu
 340 345 350

Ser Glu Gly Lys Thr Gln Ile Thr Ile Gln Thr Ser Thr Asp Glu Val
 355 360 365

Lys Lys Gln Val Glu Lys Ala Val Glu Ser Ile Asn Asn Val Leu Ser
 370 375 380

Lys Ile Gln Glu Leu Thr Lys Ala Thr Ala Glu Asp Lys Asp Asp Ser
 385 390 395 400

Lys Asp Thr Ser Ser Ser Ser Ser Lys Ile Pro Ser Tyr Leu Gln Ser
 405 410 415

Pro Thr Lys Val Lys Ala Gly Leu Phe Thr Gly Asp Thr Gly Ile Gln
 420 425 430

Met Leu Ser Thr Arg Leu Lys Ser Ile Phe Ser Ser Asn Gly Leu Gly
 435 440 445

Phe Ser Pro Lys Gln Thr Gln Asp Gly Pro Gly Asp Leu Phe Ser Ser
 450 455 460

Leu Ala Ser Ile Gly Ile Val Val Asp Ala Asp Glu Gly Ser Glu Thr
 465 470 475 480

Phe Gly Gln Leu Lys Ile Leu Asp Arg Glu Thr Ile Gly Pro Asp Ala
 485 490 495

Pro Tyr Thr Thr Leu Asp Glu Ala Leu Lys Lys Asp Pro Gln Ala Val
 500 505 510

Ala Asp Ile Leu Ala Gly Ser Ser Gly Ile Ser Asp Ser Thr Asp Phe
 515 520 525

Ser Tyr Gln Asp His Ile Val Gly Lys Thr Gln Ala Gly Thr Tyr Asp
 530 535 540

Val Lys Tyr Ser Val Asp Ala Ser Gly Thr Ile Gly Asp Val Tyr Ile
 545 550 555 560

Gly Gly Val Lys Ala Ser Leu Ser Asp Pro Ala Lys Asn Ile Tyr Thr
 565 570 575

Val Thr Ser Gly Pro Ala Thr Gly Leu Ser Ile Ala Val Asn Asn Arg
 580 585 590

Thr Pro Gly Ile Asn Val Glu Ser Thr Val Arg Val Lys Gln Gly Lys
 595 600 605

Leu Ser Gln Ile Gln Glu Ala Leu Lys Ala Glu Val Gln Gln Asp Pro
 610 615 620

Leu Lys Glu Asn Thr Gly Pro Leu Ile Ile Met Gln Asp Asn Tyr Lys
 625 630 635 640

Asp Val Met Lys Asn Leu Glu Thr Arg Ile Glu Lys Glu Thr Gln Arg
 645 650 655

Val Thr Ser Trp Glu Arg Met Met Arg Leu Lys Phe Ser Arg Leu Asp
 660 665 670

Ala Val Leu Ala Lys Tyr Asn Gln Met Met Ser Ala Asn Ala Ser Ser
 675 680 685

Leu Gly Gln Leu Gly Ala
 690

<210> 11
 <211> 1200
 <212> DNA
 <213> *Lawsonia intracellularis*

<220>
 <221> CDS
 <222> (13)..(1200)

<400> 11
 taggagatag tt atg gct aat gtt agt gga atc cct gca cca cga tta ctt 51
 Met Ala Asn Val Ser Gly Ile Pro Ala Pro Arg Leu Leu
 1 5 10

tcc aca aca aat caa atg acc aat gca gct gct ggt aat act aat aga 99
 Ser Thr Thr Asn Gln Met Thr Asn Ala Ala Ala Gly Asn Thr Asn Arg
 15 20 25

gct acc ggt agt atg aac ggt cgt aat ctc aca caa ata aaa aca cct 147
 Ala Thr Gly Ser Met Asn Gly Arg Asn Leu Thr Gln Ile Lys Thr Pro

30	35	40	45	
cag tcc atg att gat aat gct tca gaa gaa tta aca act tct ctt gaa				195
Gln Ser Met Ile Asp Asn Ala Ser Glu Glu Leu Thr Thr Ser Leu Glu	50	55	60	
tct aaa agc agt gac gac ttt gca att aaa gat cgt aaa aga caa ggg				243
Ser Lys Ser Ser Asp Asp Phe Ala Ile Lys Asp Arg Lys Arg Gln Gly	65	70	75	
aaa gga tct gat tct cta tta aaa atg gtt caa gaa tat aca gag ctg				291
Lys Gly Ser Asp Ser Leu Leu Lys Met Val Gln Glu Tyr Thr Glu Leu	80	85	90	
acg aat gat gat acc cgt aat gct aaa aga gct atg tta tcc cag gta				339
Thr Asn Asp Asp Thr Arg Asn Ala Lys Arg Ala Met Leu Ser Gln Val	95	100	105	
tta cgt gca agt caa agt tca caa gat gta ctc gaa aaa aca tta gaa				387
Leu Arg Ala Ser Gln Ser Ser Gln Asp Val Leu Glu Lys Thr Leu Glu	110	115	120	125
caa ttt tct aat aaa aca gat gct tgg gct tct ctt gca gaa att gca				435
Gln Phe Ser Asn Lys Thr Asp Ala Trp Ala Ser Leu Ala Glu Ile Ala	130	135	140	
caa gaa tat ggt gca gaa tct cca cag cca aca gga tta aaa tct gta				483
Gln Glu Tyr Gly Ala Glu Ser Pro Gln Pro Thr Gly Leu Lys Ser Val	145	150	155	
tta gat gct atg gag aca tta gaa aat gag ttt ggt gat gaa att aaa				531
Leu Asp Ala Met Glu Thr Leu Leu Asn Glu Phe Gly Asp Glu Ile Lys	160	165	170	
gca gga cta aaa gga gct cta aat tca aaa gaa ttt act gat ata ggc				579
Ala Gly Leu Lys Gly Ala Leu Asn Ser Lys Glu Phe Thr Asp Ile Gly	175	180	185	
agt gca gca cag tta aga gat ctt tat aca aca aca gta act ata aca				627
Ser Ala Ala Gln Leu Arg Asp Leu Tyr Thr Thr Thr Val Thr Ile Thr	190	195	200	205
gct gca cct gat gca gtg tta gca aga ctt ctt gaa gaa tat gag agt				675
Ala Ala Pro Asp Ala Val Leu Ala Arg Leu Leu Glu Glu Tyr Glu Ser	210	215	220	
gat gat gat ctg gat aga gcc att gat ttc ctt cta tct aca ctt ggt				723
Asp Asp Asp Leu Asp Arg Ala Ile Asp Phe Leu Leu Ser Thr Leu Gly	225	230	235	
gga gag ctt gaa tca gct gat cca agt atg gat aaa gta cat ctt caa				771
Gly Glu Leu Glu Ser Ala Asp Pro Ser Met Asp Lys Val His Leu Gln	240	245	250	
agt gta atg ggt gat att gaa aaa aca caa caa ctt cat agc tct cat				819
Ser Val Met Gly Asp Ile Glu Lys Thr Gln Gln Leu His Ser Ser His	255	260	265	
aaa caa tgt act aca gcc ctt agc agg tgg aaa gag aaa cat aaa ggt				867
Lys Gln Cys Thr Thr Ala Leu Ser Arg Trp Lys Glu Lys His Lys Gly	270	275	280	285
ggg ggg gaa aat agt aca cta act cct tta gaa atg atg cgt gaa cta				915
Gly Gly Glu Asn Ser Thr Leu Thr Pro Leu Glu Met Met Arg Glu Leu	290	295	300	

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att gca cta aaa aat gaa aat ttt att tct cct tcc tct ata gat aaa      963
Ile Ala Leu Lys Asn Glu Asn Phe Ile Ser Pro Ser Ser Ile Asp Lys
              305                      310                      315

att gtt gat caa gct gat ccc caa gat att gaa aaa gaa gtc ctt ttt      1011
Ile Val Asp Gln Ala Asp Pro Gln Asp Ile Glu Lys Glu Val Leu Phe
              320                      325                      330

tta caa gag atg tta gct gct gta aga aaa ttt ccc att atg gta ttt      1059
Leu Gln Glu Met Leu Ala Ala Val Arg Lys Phe Pro Ile Met Val Phe
              335                      340                      345

gat aat gtc gaa aat cgt gta aga gtt atg ggt gct gta caa gat gct      1107
Asp Asn Val Glu Asn Arg Val Arg Val Met Gly Ala Val Gln Asp Ala
              350                      355                      360                      365

gtt gac gat gct gta aga aga gaa gat gaa ttc ctc ttt caa aaa gaa      1155
Val Asp Asp Ala Val Arg Arg Glu Asp Glu Phe Leu Phe Gln Lys Glu
              370                      375                      380

cat cct gat gta cca cta caa cca gat gaa aat aat ata caa taa      1200
His Pro Asp Val Pro Leu Gln Pro Asp Glu Asn Asn Ile Gln
              385                      390                      395

<210> 12
<211> 395
<212> PRT
<213> Lawsonia intracellularis

<400> 12

Met Ala Asn Val Ser Gly Ile Pro Ala Pro Arg Leu Leu Ser Thr Thr
1              5              10              15

Asn Gln Met Thr Asn Ala Ala Ala Gly Asn Thr Asn Arg Ala Thr Gly
              20              25              30

Ser Met Asn Gly Arg Asn Leu Thr Gln Ile Lys Thr Pro Gln Ser Met
              35              40              45

Ile Asp Asn Ala Ser Glu Glu Leu Thr Thr Ser Leu Glu Ser Lys Ser
              50              55              60

Ser Asp Asp Phe Ala Ile Lys Asp Arg Lys Arg Gln Gly Lys Gly Ser
65              70              75              80

Asp Ser Leu Leu Lys Met Val Gln Glu Tyr Thr Glu Leu Thr Asn Asp
              85              90              95

Asp Thr Arg Asn Ala Lys Arg Ala Met Leu Ser Gln Val Leu Arg Ala
              100              105              110

Ser Gln Ser Ser Gln Asp Val Leu Glu Lys Thr Leu Glu Gln Phe Ser
              115              120              125

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Asn Lys Thr Asp Ala Trp Ala Ser Leu Ala Glu Ile Ala Gln Glu Tyr
 130 135 140
 Gly Ala Glu Ser Pro Gln Pro Thr Gly Leu Lys Ser Val Leu Asp Ala
 145 150 155 160
 Met Glu Thr Leu Glu Asn Glu Phe Gly Asp Glu Ile Lys Ala Gly Leu
 165 170 175
 Lys Gly Ala Leu Asn Ser Lys Glu Phe Thr Asp Ile Gly Ser Ala Ala
 180 185 190
 Gln Leu Arg Asp Leu Tyr Thr Thr Thr Val Thr Ile Thr Ala Ala Pro
 195 200 205
 Asp Ala Val Leu Ala Arg Leu Leu Glu Glu Tyr Glu Ser Asp Asp Asp
 210 215 220
 Leu Asp Arg Ala Ile Asp Phe Leu Leu Ser Thr Leu Gly Gly Glu Leu
 225 230 235 240
 Glu Ser Ala Asp Pro Ser Met Asp Lys Val His Leu Gln Ser Val Met
 245 250 255
 Gly Asp Ile Glu Lys Thr Gln Gln Leu His Ser Ser His Lys Gln Cys
 260 265 270
 Thr Thr Ala Leu Ser Arg Trp Lys Glu Lys His Lys Gly Gly Gly Glu
 275 280 285
 Asn Ser Thr Leu Thr Pro Leu Glu Met Met Arg Glu Leu Ile Ala Leu
 290 295 300
 Lys Asn Glu Asn Phe Ile Ser Pro Ser Ser Ile Asp Lys Ile Val Asp
 305 310 315 320
 Gln Ala Asp Pro Gln Asp Ile Glu Lys Glu Val Leu Phe Leu Gln Glu
 325 330 335
 Met Leu Ala Ala Val Arg Lys Phe Pro Ile Met Val Phe Asp Asn Val
 340 345 350
 Glu Asn Arg Val Arg Val Met Gly Ala Val Gln Asp Ala Val Asp Asp
 355 360 365
 Ala Val Arg Arg Glu Asp Glu Phe Leu Phe Gln Lys Glu His Pro Asp
 370 375 380
 Val Pro Leu Gln Pro Asp Glu Asn Asn Ile Gln

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385                               390                               395

<210> 13
<211> 1269
<212> DNA
<213> Lawsonia intracellularis

<220>
<221> CDS
<222> (32)..(1222)

<400> 13
tggtggaaat tctctctgga ggagtaaagc a atg aca aat ttt gga gat ata      52
                               Met Thr Asn Phe Gly Asp Ile
                               1                               5

agc gga agc tcc gca aga atg agt agc ttg atg act ggt aca tcc ggt      100
Ser Gly Ser Ser Ala Arg Met Ser Ser Leu Met Thr Gly Thr Ser Gly
          10                      15                      20

gaa gaa gga ctt gaa gaa ctt gaa ggt ggt gtt cct aaa gag caa ggt      148
Glu Glu Gly Leu Glu Glu Leu Glu Gly Gly Val Pro Lys Glu Gln Gly
          25                      30                      35

ggt cca ggt aaa gga gat gct tca gag gct gct aaa ggt caa gca gca      196
Gly Pro Gly Lys Gly Asp Ala Ser Glu Ala Ala Lys Gly Gln Ala Ala
          40                      45                      50                      55

gca gat agt att aat tca gct ggt ggt act gaa aag cct gga gaa gtt      244
Ala Asp Ser Ile Asn Ser Ala Gly Gly Thr Glu Lys Pro Gly Glu Val
          60                      65                      70

ggt gat aag gaa gat gta ggg gaa ggt ggc gaa ata cct gaa ggt ggt      292
Gly Asp Lys Glu Asp Val Gly Glu Gly Gly Glu Ile Pro Glu Gly Gly
          75                      80                      85

gaa ata cct gag ggt ggt gaa gaa gtt cca gag gaa ccc cca tat gtc      340
Glu Ile Pro Glu Gly Gly Glu Glu Val Pro Glu Glu Pro Pro Tyr Val
          90                      95                      100

cct cct cca ttg gtt gaa cca gct aaa atc agt aca gta aca gat ctc      388
Pro Pro Pro Leu Val Glu Pro Ala Lys Ile Ser Thr Val Thr Asp Leu
          105                      110                      115

agt acg tta atg gga tca cta cag ctg aca gag caa aaa aag aat gct      436
Ser Thr Leu Met Gly Ser Leu Gln Leu Thr Glu Gln Lys Lys Asn Ala
          120                      125                      130                      135

gaa aaa aca gta aat gaa att aaa gca cag aat aaa gag caa caa gta      484
Glu Lys Thr Val Asn Glu Ile Lys Ala Gln Asn Lys Glu Gln Gln Val
          140                      145                      150

aag ttc caa gag caa att aaa aag att gag gat aat att gct gaa tct      532
Lys Phe Gln Glu Gln Ile Lys Lys Ile Glu Asp Asn Ile Ala Glu Ser
          155                      160                      165

aag aaa agt ggt ata ctt aag ttt ttc caa aag ttg ttt gca gtt att      580
Lys Lys Ser Gly Ile Leu Lys Phe Phe Gln Lys Leu Phe Ala Val Ile
          170                      175                      180

ggt gct gta cta gga gct att gga ggt gcg cta gct att gct gca ggt      628
Gly Ala Val Leu Gly Ala Ile Gly Gly Ala Leu Ala Ile Ala Ala Gly
          185                      190                      195

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gct gct tca ggt aac cca tta ttg gtt gct gca ggt att atg gct att 676
 Ala Ala Ser Gly Asn Pro Leu Leu Val Ala Ala Gly Ile Met Ala Ile
 200 205 210 215

gta gct tca att gat gca gca atg tcg tcg cta tcg gat ggt aaa gtg 724
 Val Ala Ser Ile Asp Ala Ala Met Ser Ser Leu Ser Asp Gly Lys Val
 220 225 230

tcc atc tca gca ggg att agt aag gct ctt gag gct atg gga gta cca 772
 Ser Ile Ser Ala Gly Ile Ser Lys Ala Leu Glu Ala Met Gly Val Pro
 235 240 245

gca gaa aca gca caa tgg att gca ttt ggt ata cag tta gca atg att 820
 Ala Glu Thr Ala Gln Trp Ile Ala Phe Gly Ile Gln Leu Ala Met Ile
 250 255 260

gca gtg act ata gct att ggt ttt gcc tct ggt ggt ggt gga gca atg 868
 Ala Val Thr Ile Ala Ile Gly Phe Ala Ser Gly Gly Gly Gly Ala Met
 265 270 275

gct gga gtg tca aaa ata gca gat atg ttt tca aag tct caa gat gta 916
 Ala Gly Val Ser Lys Ile Ala Asp Met Phe Ser Lys Ser Gln Asp Val
 280 285 290 295

gct aag ttg gca cag atg att gaa aaa gct tct aaa ata gta caa atc 964
 Ala Lys Leu Ala Gln Met Ile Glu Lys Ala Ser Lys Ile Val Gln Ile
 300 305 310

gct ggt tca gtt aat cag tct gct ata ggc ggt aca ggt att ggt aca 1012
 Ala Gly Ser Val Asn Gln Ser Ala Ile Gly Gly Thr Gly Ile Gly Thr
 315 320 325

gct gta gtg caa agc aat ata aaa gct aat gaa tct gaa caa aaa gaa 1060
 Ala Val Val Gln Ser Asn Ile Lys Ala Asn Glu Ser Glu Gln Lys Glu
 330 335 340

att gaa gct gct att gca aaa gtt aaa gct aag ata gag acg tta caa 1108
 Ile Glu Ala Ala Ile Ala Lys Val Lys Ala Lys Ile Glu Thr Leu Gln
 345 350 355

gac ttc ttt aaa aac caa atg gaa caa ttc aat gct ata atg aaa ata 1156
 Asp Phe Phe Lys Asn Gln Met Glu Gln Phe Asn Ala Ile Met Lys Ile
 360 365 370 375

ata aca gat att att caa gat agc gtc aat aca aaa ata gct gtt caa 1204
 Ile Thr Asp Ile Ile Gln Asp Ser Val Asn Thr Lys Ile Ala Val Gln
 380 385 390

cgt ggt gca cgt gag taa tacctttagt aaatacagtg actatactat 1252
 Arg Gly Ala Arg Glu
 395

aatatataaa ttaataa 1269

<210> 14
 <211> 396
 <212> PRT
 <213> *Lawsonia intracellularis*

<400> 14

Met Thr Asn Phe Gly Asp Ile Ser Gly Ser Ser Ala Arg Met Ser Ser
 1 5 10 15

Leu Met Thr Gly Thr Ser Gly Glu Glu Gly Leu Glu Glu Leu Glu Gly
 20 25 30

Gly Val Pro Lys Glu Gln Gly Gly Pro Gly Lys Gly Asp Ala Ser Glu
 35 40 45

Ala Ala Lys Gly Gln Ala Ala Ala Asp Ser Ile Asn Ser Ala Gly Gly
 50 55 60

Thr Glu Lys Pro Gly Glu Val Gly Asp Lys Glu Asp Val Gly Glu Gly
 65 70 75 80

Gly Glu Ile Pro Glu Gly Gly Glu Ile Pro Glu Gly Gly Glu Glu Val
 85 90 95

Pro Glu Glu Pro Pro Tyr Val Pro Pro Pro Leu Val Glu Pro Ala Lys
 100 105 110

Ile Ser Thr Val Thr Asp Leu Ser Thr Leu Met Gly Ser Leu Gln Leu
 115 120 125

Thr Glu Gln Lys Lys Asn Ala Glu Lys Thr Val Asn Glu Ile Lys Ala
 130 135 140

Gln Asn Lys Glu Gln Gln Val Lys Phe Gln Glu Gln Ile Lys Lys Ile
 145 150 155 160

Glu Asp Asn Ile Ala Glu Ser Lys Lys Ser Gly Ile Leu Lys Phe Phe
 165 170 175

Gln Lys Leu Phe Ala Val Ile Gly Ala Val Leu Gly Ala Ile Gly Gly
 180 185 190

Ala Leu Ala Ile Ala Ala Gly Ala Ala Ser Gly Asn Pro Leu Leu Val
 195 200 205

Ala Ala Gly Ile Met Ala Ile Val Ala Ser Ile Asp Ala Ala Met Ser
 210 215 220

Ser Leu Ser Asp Gly Lys Val Ser Ile Ser Ala Gly Ile Ser Lys Ala
 225 230 235 240

Leu Glu Ala Met Gly Val Pro Ala Glu Thr Ala Gln Trp Ile Ala Phe
 245 250 255

Gly Ile Gln Leu Ala Met Ile Ala Val Thr Ile Ala Ile Gly Phe Ala
 260 265 270

Ser Gly Gly Gly Gly Ala Met Ala Gly Val Ser Lys Ile Ala Asp Met
 275 280 285

Phe Ser Lys Ser Gln Asp Val Ala Lys Leu Ala Gln Met Ile Glu Lys
 290 295 300

Ala Ser Lys Ile Val Gln Ile Ala Gly Ser Val Asn Gln Ser Ala Ile
 305 310 315 320

Gly Gly Thr Gly Ile Gly Thr Ala Val Val Gln Ser Asn Ile Lys Ala
 325 330 335

Asn Glu Ser Glu Gln Lys Glu Ile Glu Ala Ala Ile Ala Lys Val Lys
 340 345 350

Ala Lys Ile Glu Thr Leu Gln Asp Phe Phe Lys Asn Gln Met Glu Gln
 355 360 365

Phe Asn Ala Ile Met Lys Ile Ile Thr Asp Ile Ile Gln Asp Ser Val
 370 375 380

Asn Thr Lys Ile Ala Val Gln Arg Gly Ala Arg Glu
 385 390 395

<210> 15
 <211> 894
 <212> DNA
 <213> *Lawsonia intracellularis*

<220>
 <221> CDS
 <222> (13)..(894)

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 gct caa cgt aac tta agc aag tct tat gga gaa ctg agt tct tct gtt 99
 Ala Gln Arg Asn Leu Ser Lys Ser Tyr Gly Glu Leu Ser Ser Ser Val
 15 20 25
 cga aaa ctt tct tca ggt ctt cgt gta gga act gct gct gat gac tca 147
 Arg Lys Leu Ser Ser Gly Leu Arg Val Gly Thr Ala Ala Asp Asp Ser
 30 35 40 45
 gca ggg tta gcc att cga gaa ctc atg aga tct gac att gca aca aca 195
 Ala Gly Leu Ala Ile Arg Glu Leu Met Arg Ser Asp Ile Ala Thr Thr
 50 55 60
 caa caa gga ata cga aat gcg aat gat gct att tct atg att caa act 243
 Gln Gln Gly Ile Arg Asn Ala Asn Asp Ala Ile Ser Met Ile Gln Thr
 65 70 75
 gcg gat ggt gca ctt gga gtc atc gat gaa aag ctc att cga atg aaa 291

Ala	Asp	Gly	Ala	Leu	Gly	Val	Ile	Asp	Glu	Lys	Leu	Ile	Arg	Met	Lys		
		80					85					90					
gaa	ctt	gct	gaa	caa	gct	gct	aca	ggc	aca	tat	aac	tcc	act	cag	cgt	339	
Glu	Leu	Ala	Glu	Gln	Ala	Ala	Thr	Gly	Thr	Tyr	Asn	Ser	Thr	Gln	Arg		
	95					100					105						
atg	att	att	gac	tct	gaa	tat	caa	gct	atg	gcc	tca	gaa	att	act	cgt	387	
Met	Ile	Ile	Asp	Ser	Glu	Tyr	Gln	Ala	Met	Ala	Ser	Glu	Ile	Thr	Arg		
110					115					120					125		
att	gct	aat	gcg	aca	gaa	ttt	aat	ggc	ata	aaa	ctt	ctt	gat	ggc	tca	435	
Ile	Ala	Asn	Ala	Thr	Glu	Phe	Asn	Gly	Ile	Lys	Leu	Leu	Asp	Gly	Ser		
			130						135					140			
tta	tca	ggc	aat	cat	gat	ggg	aaa	aaa	ata	aat	tca	act	ggc	gca	gta	483	
Leu	Ser	Gly	Asn	His	Asp	Gly	Lys	Lys	Ile	Asn	Ser	Thr	Gly	Ala	Val		
			145					150					155				
cgt	atc	cac	ttt	ggg	aca	tct	aac	agc	tct	gct	gaa	gat	tac	tat	gat	531	
Arg	Ile	His	Phe	Gly	Thr	Ser	Asn	Ser	Ser	Ala	Glu	Asp	Tyr	Tyr	Asp		
		160					165					170					
att	aaa	att	ggc	ggc	tct	aca	gct	tct	gca	tta	gga	ctt	ggc	aat	aca	579	
Ile	Lys	Ile	Gly	Gly	Ser	Thr	Ala	Ser	Ala	Leu	Gly	Leu	Gly	Asn	Thr		
	175					180					185						
gta	aaa	ggc	gcg	ggc	gct	aca	gtc	tct	act	caa	gct	gca	gca	caa	aat	627	
Val	Lys	Gly	Ala	Gly	Ala	Thr	Val	Ser	Thr	Gln	Ala	Ala	Ala	Gln	Asn		
190					195					200					205		
gcc	tta	aaa	gct	ata	gat	aat	gcc	att	gtt	tca	aaa	gat	aaa	att	cga	675	
Ala	Leu	Lys	Ala	Ile	Asp	Asn	Ala	Ile	Val	Ser	Lys	Asp	Lys	Ile	Arg		
			210						215					220			
gca	cac	ctt	ggc	gga	tta	caa	aat	aga	ctt	gaa	gct	aca	gtt	gat	aat	723	
Ala	His	Leu	Gly	Gly	Leu	Gln	Asn	Arg	Leu	Glu	Ala	Thr	Val	Asp	Asn		
			225					230					235				
tta	agt	ata	caa	aat	gaa	aac	tta	caa	gct	gct	gaa	tct	cgt	ata	tct	771	
Leu	Ser	Ile	Gln	Asn	Glu	Asn	Leu	Gln	Ala	Ala	Glu	Ser	Arg	Ile	Ser		
		240					245					250					
gat	ata	gat	gta	agc	caa	gaa	atg	aca	caa	ttt	gta	cgt	aac	caa	ata	819	
Asp	Ile	Asp	Val	Ser	Gln	Glu	Met	Thr	Gln	Phe	Val	Arg	Asn	Gln	Ile		
	255					260					265						
ctt	aca	caa	aca	ggc	gtt	gct	atg	ctt	tca	caa	gct	aat	tct	cta	cca	867	
Leu	Thr	Gln	Thr	Gly	Val	Ala	Met	Leu	Ser	Gln	Ala	Asn	Ser	Leu	Pro		
270					275					280					285		
cgt	atg	gct	cag	caa	ctt	att	ggc	taa								894	
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 <212> PRT
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Ser Ser Gly Leu Arg Val Gly Thr Ala Ala Asp Asp Ser Ala Gly Leu
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Ala Ile Arg Glu Leu Met Arg Ser Asp Ile Ala Thr Thr Gln Gln Gly
 50 55 60

Ile Arg Asn Ala Asn Asp Ala Ile Ser Met Ile Gln Thr Ala Asp Gly
 65 70 75 80

Ala Leu Gly Val Ile Asp Glu Lys Leu Ile Arg Met Lys Glu Leu Ala
 85 90 95

Glu Gln Ala Ala Thr Gly Thr Tyr Asn Ser Thr Gln Arg Met Ile Ile
 100 105 110

Asp Ser Glu Tyr Gln Ala Met Ala Ser Glu Ile Thr Arg Ile Ala Asn
 115 120 125

Ala Thr Glu Phe Asn Gly Ile Lys Leu Leu Asp Gly Ser Leu Ser Gly
 130 135 140

Asn His Asp Gly Lys Lys Ile Asn Ser Thr Gly Ala Val Arg Ile His
 145 150 155 160

Phe Gly Thr Ser Asn Ser Ser Ala Glu Asp Tyr Tyr Asp Ile Lys Ile
 165 170 175

Gly Gly Ser Thr Ala Ser Ala Leu Gly Leu Gly Asn Thr Val Lys Gly
 180 185 190

Ala Gly Ala Thr Val Ser Thr Gln Ala Ala Ala Gln Asn Ala Leu Lys
 195 200 205

Ala Ile Asp Asn Ala Ile Val Ser Lys Asp Lys Ile Arg Ala His Leu
 210 215 220

Gly Gly Leu Gln Asn Arg Leu Glu Ala Thr Val Asp Asn Leu Ser Ile
 225 230 235 240

Gln Asn Glu Asn Leu Gln Ala Ala Glu Ser Arg Ile Ser Asp Ile Asp
 245 250 255

Val Ser Gln Glu Met Thr Gln Phe Val Arg Asn Gln Ile Leu Thr Gln
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Gln Gln Leu Ile Gly
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Gln Ile Ile Lys Ile Leu Leu Phe Ser Leu Cys Val Phe Phe Phe Thr
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ctt aca gaa aaa caa aaa att tat gct gca gac gtc ttt ttt gag ggc 148
Leu Thr Glu Lys Gln Lys Ile Tyr Ala Ala Asp Val Phe Phe Glu Gly
25 30 35 40

aga acc gaa acc tta atc aat gta aac aaa cca ttt gat tct ttt ttt 196
Arg Thr Glu Thr Leu Ile Asn Val Asn Lys Pro Phe Asp Ser Phe Phe
45 50 55

gga ggt tct gac tct aca ata gga acc ctt gaa aca gga cct act aat 244
Gly Gly Ser Asp Ser Thr Ile Gly Thr Leu Glu Thr Gly Pro Thr Asn
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ctt acc ttc aca aca gta gga gcc ttc cgc aat tct gtt ttc aga att 292
Leu Thr Phe Thr Thr Val Gly Ala Phe Arg Asn Ser Val Phe Arg Ile
75 80 85

att ggt ggt ggt agg tct agt ttt aac aac cca aat aca gtt aaa ggc 340
Ile Gly Gly Gly Arg Ser Ser Phe Asn Asn Pro Asn Thr Val Lys Gly
90 95 100

aat gtt act cta act gtt tat aat act gat gta gaa aga ata att ggt 388
Asn Val Thr Leu Thr Val Tyr Asn Thr Asp Val Glu Arg Ile Ile Gly
105 110 115 120

gca ggt atc agc aat aga gga ctt gta acc gtt act ggc tca gta aat 436
Ala Gly Ile Ser Asn Arg Gly Leu Val Thr Val Thr Gly Ser Val Asn
125 130 135

atg aag cta gaa aat gtt tct gtt act aga gga att tat ggt ggt gtc 484
Met Lys Leu Glu Asn Val Ser Val Thr Arg Gly Ile Tyr Gly Gly Val
140 145 150

tat act caa aat gga cat gta cta ggc tct atc aac atg cat ttg aaa 532
Tyr Thr Gln Asn Gly His Val Leu Gly Ser Ile Asn Met His Leu Lys
155 160 165

aac gtc caa act cca cta tta ata ggt tct gga gta agc aat gga cct 580

Asn	Val	Gln	Thr	Pro	Leu	Leu	Ile	Gly	Ser	Gly	Val	Ser	Asn	Gly	Pro	
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aat	cgt	att	act	gta	aat	gga	gac	ata	aac	att	gat	gtt	gaa	gac	tct	628
Asn	Arg	Ile	Thr	Val	Asn	Gly	Asp	Ile	Asn	Ile	Asp	Val	Glu	Asp	Ser	
185					190				195						200	
agg	att	caa	tat	gta	aac	att	aca	gga	gaa	gta	gat	gca	ggg	ata	aaa	676
Arg	Ile	Gln	Tyr	Val	Asn	Ile	Thr	Gly	Glu	Val	Asp	Ala	Gly	Ile	Lys	
				205					210					215		
gga	aat	gct	act	cta	act	gta	aaa	aaa	tct	act	gtt	gag	ctt	ata	aac	724
Gly	Asn	Ala	Thr	Leu	Thr	Val	Lys	Lys	Ser	Thr	Val	Glu	Leu	Ile	Asn	
			220					225					230			
tct	ggt	aga	ggt	aat	atc	tta	ggt	aat	ctc	aaa	ata	tct	ata	gca	gat	772
Ser	Gly	Arg	Gly	Asn	Ile	Leu	Gly	Asn	Leu	Lys	Ile	Ser	Ile	Ala	Asp	
		235					240						245			
tca	aat	ata	agg	ggg	tta	tca	cca	gta	gac	ttt	ggt	tct	tca	gta	tat	820
Ser	Asn	Ile	Arg	Gly	Leu	Ser	Pro	Val	Asp	Phe	Gly	Ser	Ser	Val	Tyr	
	250					255					260					
ggg	gac	aca	tct	ata	aat	gta	att	aat	tct	cag	att	aat	gat	att	act	868
Gly	Asp	Thr	Ser	Ile	Asn	Val	Ile	Asn	Ser	Gln	Ile	Asn	Asp	Ile	Thr	
265					270				275						280	
ctt	ata	cca	agg	gct	ggt	gga	atg	ctt	gta	ggt	cct	gtt	acc	cta	gat	916
Leu	Ile	Pro	Arg	Ala	Gly	Gly	Met	Leu	Val	Gly	Pro	Val	Thr	Leu	Asp	
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atc	aca	agc	agt	act	ata	caa	aat	ata	caa	tgt	ggg	cct	gtc	agt	caa	964
Ile	Thr	Ser	Ser	Thr	Ile	Gln	Asn	Ile	Gln	Cys	Gly	Pro	Val	Ser	Gln	
			300					305					310			
aat	aat	caa	ctt	aac	aca	cta	aat	gta	act	gtt	aat	act	agt	aac	att	1012
Asn	Asn	Gln	Leu	Asn	Thr	Leu	Asn	Val	Thr	Val	Asn	Thr	Ser	Asn	Ile	
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act	aac	tta	aac	ctt	ggt	agt	gtc	gaa	ggt	cat	aca	ata	tca	act	aca	1060
Thr	Asn	Leu	Asn	Leu	Gly	Ser	Val	Glu	Gly	His	Thr	Ile	Ser	Thr	Thr	
	330					335					340					
gca	act	gtt	act	gat	agt	aat	att	act	aac	ctt	aat	gtc	gga	acc	ttc	1108
Ala	Thr	Val	Thr	Asp	Ser	Asn	Ile	Thr	Asn	Leu	Asn	Val	Gly	Thr	Phe	
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aat	gga	ctt	gga	gta	act	gag	aat	gcc	tct	gta	atc	att	aat	agt	ggc	1156
Asn	Gly	Leu	Gly	Val	Thr	Glu	Asn	Ala	Ser	Val	Ile	Ile	Asn	Ser	Gly	
				365					370					375		
aat	att	act	aac	ctt	aat	gtc	gga	act	aat	gta	ata	gct	gca	gcc	aca	1204
Asn	Ile	Thr	Asn	Leu	Asn	Val	Gly	Thr	Asn	Val	Ile	Ala	Ala	Ala	Thr	
			380					385					390			
act	att	aat	tcc	tct	gcg	acc	ata	cac	gac	gga	ctt	att	gca	aac	ctt	1252
Thr	Ile	Asn	Ser	Ser	Ala	Thr	Ile	His	Asp	Gly	Leu	Ile	Ala	Asn	Leu	
		395					400					405				
acc	tta	ggc	tca	caa	ggt	aat	ggt	cgt	act	atg	ata	gct	aca	gca	aat	1300
Thr	Leu	Gly	Ser	Gln	Gly	Asn	Gly	Arg	Thr	Met	Ile	Ala	Thr	Ala	Asn	
	410					415					420					
gtt	aat	ggt	gga	act	att	gga	tta	tta	act	atg	ggt	tca	gaa	aac	ttc	1348
Val	Asn	Gly	Gly	Thr	Ile	Gly	Leu	Leu	Thr	Met	Gly	Ser	Glu	Asn	Phe	

425		430		435		440	
ata cca ggc aca aga cca att act gaa tta gca ata cta aac atg tct							1396
Ile Pro Gly Thr Arg Pro Ile Thr Glu Leu Ala Ile Leu Asn Met Ser							
		445		450		455	
ggg gga tta att gaa aga att atc gta ggt aat gcc aac tct tca acc							1444
Gly Gly Leu Ile Glu Arg Ile Ile Val Gly Asn Ala Asn Ser Ser Thr							
		460		465		470	
ata aac ttt act cct ggg aag aga tca att gta aaa aca ata aat ggt							1492
Ile Asn Phe Thr Pro Gly Lys Arg Ser Ile Val Lys Thr Ile Asn Gly							
		475		480		485	
cca gaa ctt cca tat tta gtt aac ata caa aaa ggt gct atg aca caa							1540
Pro Glu Leu Pro Tyr Leu Val Asn Ile Gln Lys Gly Ala Met Thr Gln							
		490		495		500	
tgg ggc act aaa aat atg ccc ttt tta ttg gat aca aga aat tta atc							1588
Trp Gly Thr Lys Asn Met Pro Phe Leu Leu Asp Thr Arg Asn Leu Ile							
505		510		515		520	
ttg tcc gga act ctg att acc tca aat att caa cta gct gat tta tct							1636
Leu Ser Gly Thr Leu Ile Thr Ser Asn Ile Gln Leu Ala Asp Leu Ser							
		525		530		535	
ata acc aat cta ttt gtt gct aat ggc ggt aca cta gta cct aga aaa							1684
Ile Thr Asn Leu Phe Val Ala Asn Gly Gly Thr Leu Val Pro Arg Lys							
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tta ata cct ggg aac caa cct gtt ata cag ttt ctt gga ggt cct caa							1732
Leu Ile Pro Gly Asn Gln Pro Val Ile Gln Phe Leu Gly Gly Pro Gln							
		555		560		565	
tca ctc tta gtt atc cat caa cca tta aaa gta aat tta agc tta tca							1780
Ser Leu Leu Val Ile His Gln Pro Leu Lys Val Asn Leu Ser Leu Ser							
		570		575		580	
cca aaa ctt att gga agt agc atg gtg cca ctt gct ttt gtc tct caa							1828
Pro Lys Leu Ile Gly Ser Ser Met Val Pro Leu Ala Phe Val Ser Gln							
585		590		595		600	
tct ttt tca tca cca gat ctt ttt gtt aaa caa act aga agt ggt ctc							1876
Ser Phe Ser Ser Pro Asp Leu Phe Val Lys Gln Thr Arg Ser Gly Leu							
		605		610		615	
att tgg agt gat ctt gag ttt gat cca aca aca tct att tgg tat gtt							1924
Ile Trp Ser Asp Leu Glu Phe Asp Pro Thr Thr Ser Ile Trp Tyr Val							
		620		625		630	
aat aat atc caa gca tct caa gat ttt tac tct ttc tct att gct cgt							1972
Asn Asn Ile Gln Ala Ser Gln Asp Phe Tyr Ser Phe Ser Ile Ala Arg							
		635		640		645	
gag act act aac tgg cta aga caa caa cat ata tgg act cta caa aac							2020
Glu Thr Thr Asn Trp Leu Arg Gln Gln His Ile Trp Thr Leu Gln Asn							
		650		655		660	
cgt tca agt aaa ctt tta gac aac gaa cat tat gga cta tgg ata aat							2068
Arg Ser Ser Lys Leu Leu Asp Asn Glu His Tyr Gly Leu Trp Ile Asn							
		665		670		675	680
gtt caa ggt gga cat gaa agt ctt gat act tct att ggt agc aaa gca							2116
Val Gln Gly Gly His Glu Ser Leu Asp Thr Ser Ile Gly Ser Lys Ala							
		685		690		695	

aaa atg cca tgg ata atg gca aca gca gga tat gac tat ctt caa caa Lys Met Pro Trp Ile Met Ala Thr Ala Gly Tyr Asp Tyr Leu Gln Gln 700 705 710	2164
cta cca agg tta gat atg aaa gcc ctt tat ggt ctt gct ttt ggt gct Leu Pro Arg Leu Asp Met Lys Ala Leu Tyr Gly Leu Ala Phe Gly Ala 715 720 725	2212
tct aaa ggt aaa agt aaa tgg tct agc gtc aac tct aca aaa aat gat Ser Lys Gly Lys Ser Lys Trp Ser Ser Val Asn Ser Thr Lys Asn Asp 730 735 740	2260
gct gag cta ggt atg gtt agt ggt tat gta ggt ctt atc cat aac aaa Ala Glu Leu Gly Met Val Ser Gly Tyr Val Gly Leu Ile His Asn Lys 745 750 755 760	2308
act ggg ctc tat agt aca ttg acc tta caa ctt gcg tct agt aaa tta Thr Gly Leu Tyr Ser Thr Leu Thr Leu Gln Leu Ala Ser Ser Lys Leu 765 770 775	2356
cat act aat tct aca ggg ttc tat aga aat ttt aaa tgg aca gaa aca His Thr Asn Ser Thr Gly Phe Tyr Arg Asn Phe Lys Trp Thr Glu Thr 780 785 790	2404
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ggt att aaa atg aat cct cgt gga caa ctt att ttt gaa caa aca tct Gly Ile Lys Met Asn Pro Arg Gly Gln Leu Ile Phe Glu Gln Thr Ser 810 815 820	2500
aaa cac cat ttt gat tta gga att caa aat gat aag gct ata tta gat Lys His His Phe Asp Leu Gly Ile Gln Asn Asp Lys Ala Ile Leu Asp 825 830 835 840	2548
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cta cca gtt acc aca cct att aat ctt tat gct ggt att gaa agg ata Leu Pro Val Thr Thr Pro Ile Asn Leu Tyr Ala Gly Ile Glu Arg Ile 860 865 870	2644
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gga gat aaa gga aat gat aaa ggc att ggt ggg caa gca gga ttt aca Gly Asp Lys Gly Asn Asp Lys Gly Ile Gly Gly Gln Ala Gly Phe Thr 925 930 935	2836
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Asn Lys Pro Phe Asp Ser Phe Phe Gly Gly Ser Asp Ser Thr Ile Gly
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Thr Leu Glu Thr Gly Pro Thr Asn Leu Thr Phe Thr Thr Val Gly Ala
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Phe Arg Asn Ser Val Phe Arg Ile Ile Gly Gly Gly Arg Ser Ser Phe
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Asn Asn Pro Asn Thr Val Lys Gly Asn Val Thr Leu Thr Val Tyr Asn
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Thr Asp Val Glu Arg Ile Ile Gly Ala Gly Ile Ser Asn Arg Gly Leu
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Val Thr Val Thr Gly Ser Val Asn Met Lys Leu Glu Asn Val Ser Val
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Thr Arg Gly Ile Tyr Gly Gly Val Tyr Thr Gln Asn Gly His Val Leu
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Gly Ser Ile Asn Met His Leu Lys Asn Val Gln Thr Pro Leu Leu Ile
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Gly Ser Gly Val Ser Asn Gly Pro Asn Arg Ile Thr Val Asn Gly Asp
 180 185 190

Ile Asn Ile Asp Val Glu Asp Ser Arg Ile Gln Tyr Val Asn Ile Thr
 195 200 205

Gly Glu Val Asp Ala Gly Ile Lys Gly Asn Ala Thr Leu Thr Val Lys
 210 215 220

Lys Ser Thr Val Glu Leu Ile Asn Ser Gly Arg Gly Asn Ile Leu Gly

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Asn	Leu	Lys	Ile	Ser	Ile	Ala	Asp	Ser	Asn	Ile	Arg	Gly	Leu	Ser	Pro
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Val	Asp	Phe	Gly	Ser	Ser	Val	Tyr	Gly	Asp	Thr	Ser	Ile	Asn	Val	Ile
			260					265					270		
Asn	Ser	Gln	Ile	Asn	Asp	Ile	Thr	Leu	Ile	Pro	Arg	Ala	Gly	Gly	Met
		275					280					285			
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	290					295					300				
Ile	Gln	Cys	Gly	Pro	Val	Ser	Gln	Asn	Asn	Gln	Leu	Asn	Thr	Leu	Asn
305					310				315					320	
Val	Thr	Val	Asn	Thr	Ser	Asn	Ile	Thr	Asn	Leu	Asn	Leu	Gly	Ser	Val
			325						330					335	
Glu	Gly	His	Thr	Ile	Ser	Thr	Thr	Ala	Thr	Val	Thr	Asp	Ser	Asn	Ile
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Thr	Asn	Leu	Asn	Val	Gly	Thr	Phe	Asn	Gly	Leu	Gly	Val	Thr	Glu	Asn
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Thr	Asn	Val	Ile	Ala	Ala	Ala	Thr	Thr	Ile	Asn	Ser	Ser	Ala	Thr	Ile
385				390					395					400	
His	Asp	Gly	Leu	Ile	Ala	Asn	Leu	Thr	Leu	Gly	Ser	Gln	Gly	Asn	Gly
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Arg	Thr	Met	Ile	Ala	Thr	Ala	Asn	Val	Asn	Gly	Gly	Thr	Ile	Gly	Leu
			420					425					430		
Leu	Thr	Met	Gly	Ser	Glu	Asn	Phe	Ile	Pro	Gly	Thr	Arg	Pro	Ile	Thr
		435					440					445			
Glu	Leu	Ala	Ile	Leu	Asn	Met	Ser	Gly	Gly	Leu	Ile	Glu	Arg	Ile	Ile
	450					455					460				
Val	Gly	Asn	Ala	Asn	Ser	Ser	Thr	Ile	Asn	Phe	Thr	Pro	Gly	Lys	Arg
465					470					475				480	
Ser	Ile	Val	Lys	Thr	Ile	Asn	Gly	Pro	Glu	Leu	Pro	Tyr	Leu	Val	Asn
				485					490					495	

Ile Gln Lys Gly Ala Met Thr Gln Trp Gly Thr Lys Asn Met Pro Phe
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Leu Leu Asp Thr Arg Asn Leu Ile Leu Ser Gly Thr Leu Ile Thr Ser
 515 520 525

Asn Ile Gln Leu Ala Asp Leu Ser Ile Thr Asn Leu Phe Val Ala Asn
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Gly Gly Thr Leu Val Pro Arg Lys Leu Ile Pro Gly Asn Gln Pro Val
 545 550 555 560

Ile Gln Phe Leu Gly Gly Pro Gln Ser Leu Leu Val Ile His Gln Pro
 565 570 575

Leu Lys Val Asn Leu Ser Leu Ser Pro Lys Leu Ile Gly Ser Ser Met
 580 585 590

Val Pro Leu Ala Phe Val Ser Gln Ser Phe Ser Ser Pro Asp Leu Phe
 595 600 605

Val Lys Gln Thr Arg Ser Gly Leu Ile Trp Ser Asp Leu Glu Phe Asp
 610 615 620

Pro Thr Thr Ser Ile Trp Tyr Val Asn Asn Ile Gln Ala Ser Gln Asp
 625 630 635 640

Phe Tyr Ser Phe Ser Ile Ala Arg Glu Thr Thr Asn Trp Leu Arg Gln
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Gln His Ile Trp Thr Leu Gln Asn Arg Ser Ser Lys Leu Leu Asp Asn
 660 665 670

Glu His Tyr Gly Leu Trp Ile Asn Val Gln Gly Gly His Glu Ser Leu
 675 680 685

Asp Thr Ser Ile Gly Ser Lys Ala Lys Met Pro Trp Ile Met Ala Thr
 690 695 700

Ala Gly Tyr Asp Tyr Leu Gln Gln Leu Pro Arg Leu Asp Met Lys Ala
 705 710 715 720

Leu Tyr Gly Leu Ala Phe Gly Ala Ser Lys Gly Lys Ser Lys Trp Ser
 725 730 735

Ser Val Asn Ser Thr Lys Asn Asp Ala Glu Leu Gly Met Val Ser Gly
 740 745 750

Tyr Val Gly Leu Ile His Asn Lys Thr Gly Leu Tyr Ser Thr Leu Thr
 755 760 765
 Leu Gln Leu Ala Ser Ser Lys Leu His Thr Asn Ser Thr Gly Phe Tyr
 770 775 780
 Arg Asn Phe Lys Trp Thr Glu Thr Thr Pro Thr Glu Ala Leu Glu Leu
 785 790 795 800
 Gly Trp Lys Tyr Thr Phe Asn Asn Gly Ile Lys Met Asn Pro Arg Gly
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 Gln Leu Ile Phe Glu Gln Thr Ser Lys His His Phe Asp Leu Gly Ile
 820 825 830
 Gln Asn Asp Lys Ala Ile Leu Asp Lys Ser Gln Leu Ile Thr Ser Ser
 835 840 845
 Leu Gly Ile Thr Val Glu Tyr Lys Leu Pro Val Thr Thr Pro Ile Asn
 850 855 860
 Leu Tyr Ala Gly Ile Glu Arg Ile Lys Gly Gln Ser Gly Asn Phe Ala
 865 870 875 880
 Ile Ser Ser Gln Ser Leu Gln Met Lys Phe Lys His Asp Asn Asp Thr
 885 890 895
 Ser Val Val Arg Ala Thr Ile Gly Thr Asn Ile Leu Leu Gly Glu His
 900 905 910
 Phe Asn Ile His Cys Asp Ile Phe Gly Asp Lys Gly Asn Asp Lys Gly
 915 920 925
 Ile Gly Gly Gln Ala Gly Phe Thr Tyr Lys Phe
 930 935